

LIQUID SAMPLING SYSTEM

CONTRACTUAL ORIGIN OF THE INVENTION

The U.S. Government has rights in this invention pursuant to Contract No. DE-AC07-79ID01675 between the U.S. Department of Energy and Exxon Nuclear Idaho.

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus and method for obtaining samples of liquids from a reservoir. The invention has particular application to the sampling of hazardous or toxic liquids.

Certain processes and activities involve the use or production of large quantities of hazardous or toxic liquids. For example, quantities of radioactive liquids may be involved in the operation of nuclear reactor facilities. In the operation of such processes, it is desirable from time to time to withdraw various amounts of liquid to provide samples for use for analytical and/or control purposes in connection with the operation of the processes. However, even small samples of such liquids can exhibit vigorous and dangerous activity such that operating personnel must be protected from exposure to the liquid sample. In addition, such liquids are frequently detrimental to parts of common liquid handling equipment, such as pumps, valves and the like, and maintenance is costly because of the danger of exposure of maintenance personnel. Accordingly, conventional methods and apparatus for handling of ordinary chemical liquids are not satisfactory for handling such hazardous or toxic materials.

SUMMARY OF THE INVENTION

It is a general object of the present invention to provide an improved apparatus and method for sampling liquids, which avoids the disadvantages of prior apparatuses and methods while affording additional structural and operating advantages.

An important object of the invention is the provision of liquid sampling apparatus which is uniquely suited for the sampling of hazardous or toxic liquids.

In connection with the foregoing object, it is another object of the invention to provide apparatus of the type set forth which is uniquely susceptible of remotely controlled operation.

Another object of the invention is the provision of apparatus of the type set forth which is characterized by very low maintenance requirements.

In connection with the foregoing object, it is still another object of the invention to provide apparatus of the type set forth, which has no moving parts in contact with the liquid being sampled.

Yet another object of the invention is the provision of apparatus of the type set forth, which is entirely fluid operated.

It is another object of the invention to provide a fluid-operated method for liquid sampling.

These and other objects of the invention are attained by providing fluid-operated apparatus for withdrawing a sample of liquid from a reservoir comprising: a withdrawal conduit in fluid communication with the reservoir, fluid-operated pump means communicating with the withdrawal conduit, sample collection means including a vessel disposable in fluid communication with the withdrawal conduit upstream of the pump means, the pump means reducing the pressure in the conduit for

evacuating gas therefrom and from the sample collection vessel for inducing liquid flow through the conduit from the reservoir, and fluid-operated means responsive to the arrival of liquid from the reservoir at the pump means for raising the pressure in the withdrawal conduit at the sample collection vessel for causing liquid to flow into the vessel.

Additional objects, advantages and novel features of the invention will be set forth in part in the description which follows, and in part will become apparent to those skilled in the art upon examination of the following or may be learned by practice of the invention. The objects and advantages of the invention may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

DESCRIPTION OF THE FIGURES

For the purpose of facilitating an understanding of the invention, there is illustrated in the accompanying drawings a preferred embodiment thereof, from an inspection of which, when considered in connection with the following description, the invention, its construction and operation, and many of its advantages should be readily understood and appreciated.

FIG. 1 is a fragmentary, partially schematic view of a liquid sampling system constructed in accordance with and embodying the features of the present invention;

FIG. 2 is an enlarged, fragmentary, perspective view of a portion of the system illustrated in FIG. 1;

FIG. 3 is a further enlarged, exploded perspective view of the sample collection assembly within the line 3 of FIG. 2;

FIG. 4 is an enlarged view in vertical section of the jet ejector of the present invention, taken along the line 4—4 in FIG. 2 and rotated 90° counterclockwise; and

FIG. 5 is an enlarged sectional view of the air lift of FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, there is illustrated a liquid sampling system, generally designated by the numeral 10, constructed in accordance with and embodying the features of the present invention. A closed reservoir 11 contains a liquid 12 to a level 13. The liquid 12 could be any liquid which needs to be sampled, but for purposes of discussion of the present invention, it will be assumed that the liquid 12 is a hazardous or toxic liquid, such as a radioactive liquid. Also, while the reservoir 11 is illustrated as a closed reservoir, it will be appreciated that it could also be any other type of liquid entrapment area.

The reservoir 11 is disposed on one side of an isolation wall 14, which may be formed of concrete or any other suitable material. Connected to the wall 14 and extending from the side thereof opposite the reservoir 11 is a floor 15 on which is disposed a sampling station 16, which is in turn separated by an isolation wall 17 from a control station 18. The floor 15 and the isolation wall 17 may be formed of the same material as the isolation wall 14, and a viewing window 19 of suitable material may be formed in the isolation wall 17 so that personnel at the control station 18 may view activity in the sampling station 16.

A suction or withdrawal conduit 20 passes through the isolation wall 14 to the sampling station 16. One end of the conduit 20 is disposed near the bottom of the